Modelling and Fabrication of Semi-Automatic pneumatic number and word punching on metal job machine.

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INTRODUCTION

Pneumatic System

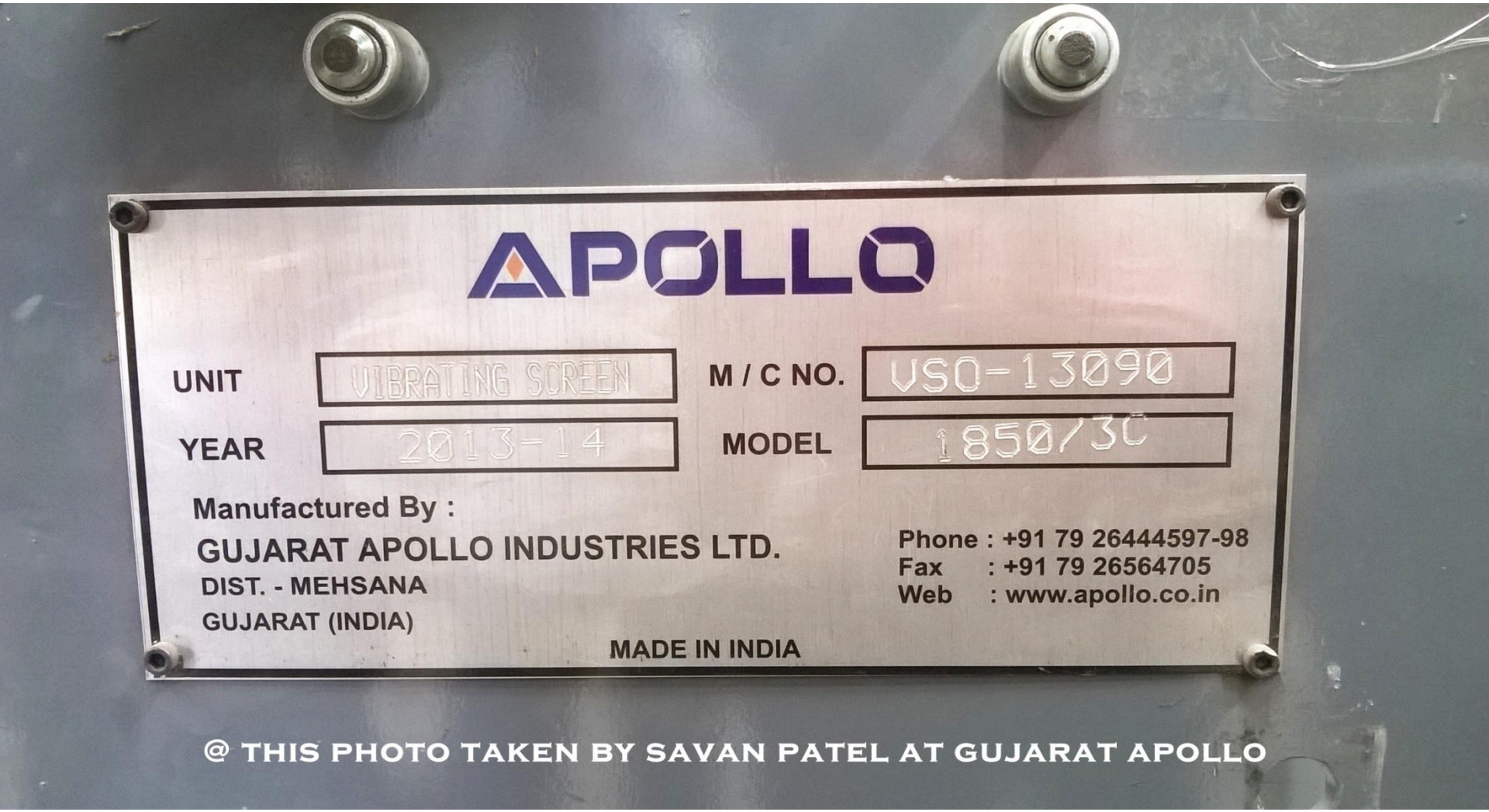
- A pneumatic system is a system that uses compressed air to transmit and control energy.

- Pneumatic systems are used in **controlling train doors, automatic production lines, mechanical clamps** etc.

Why we choose the Pneumatic system?

- High effectiveness
- High durability and reliability
- Simple design
- High adaptability to harsh environment
- Safety
- Easy selection of speed and pressure
- Environmental friendly
- Economical

When this idea come from ?



Objectives of the present Investigation

➢ In this project work, we will manufacture a semi automatic pneumatic punching machine with **very less cost comparing to computer machine** and **try to maintain same quality of punching.**

Literature Review

1. Design of a Pressure Observer and its Application to a Low-Cost Pneumatic Control System [1]	→ Pneumatic systems and observer-based approaches for controlling position and stiffness eliminate the need for pressure and force sensors. → Estimates pressure in the pneumatic actuator chamber, acting instead of a sensor.
2. Design and applications of a pneumatic accelerator for high speed punching [2]	→ Design and manufacture an accelerator as an energy converter to form the different types of metals in high speed. Instead of using high speed forming machines, developing some energy converter systems that convert different types of energy into mechanical energy are preferable.

3. Development of Micro Punching System [5]	→ A micro hole punching system was developed and micro holes of 100μm in diameter were successfully made on brass sheets of 100μm in thickness. → Currently effort is underway to punch holes of 50μm in diameter by modifying the present punching system.
4. Flexible punching method using an elastic tool instead of a metal punch [7]	→ Elastic tool that consists of a urethane sheet and a metal die is used for punching instead of a conventional metal punch and die. → A suitable thickness of the urethane is within the range of 3.0–5.0 mm. The desirable ratio d/R between the radius of the metal punch R and hole diameter d is within the range from 0.48 to 0.64.

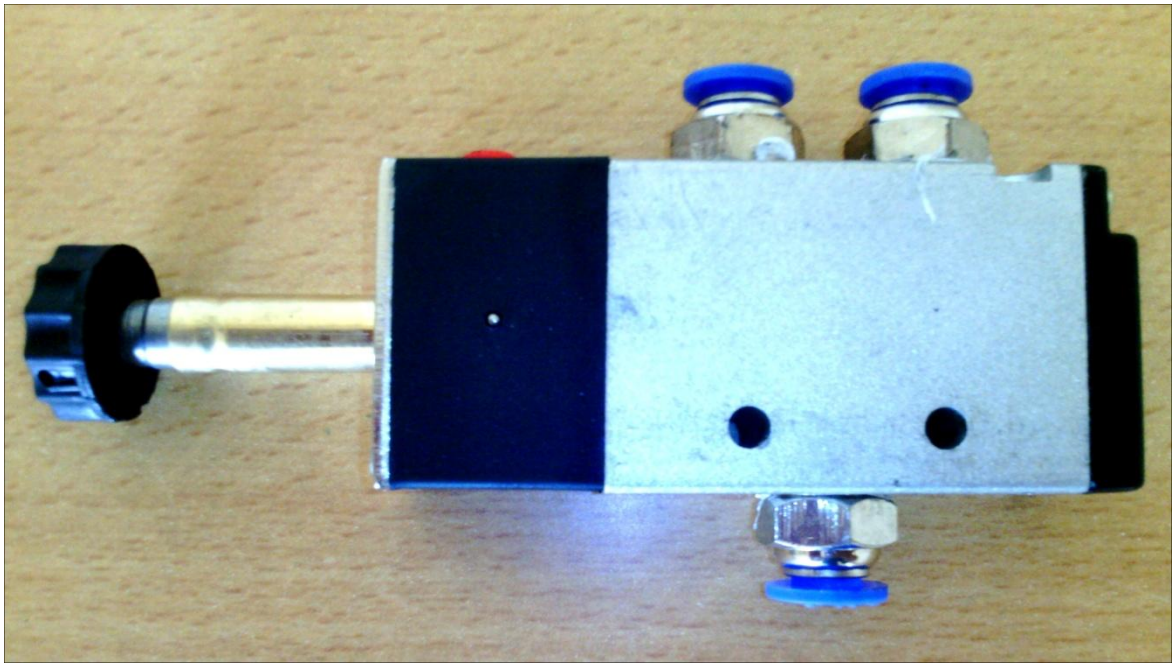
5. The development of hi-speed punching system using a couple of rotating bodies[11]	→ To punch a sequence of tiny hole just a few millimeters apart, the feed speed of a strip of a metal to the punching machine cannot exceed 2m/min. We have therefore developed a new technique such as the feeding speed can be up to 100 m/min. → The precision of whole sizes and pitches is good even in the punching at high speeds because it is determined by the size of punching tools, which means that the new technique requires no feeder.

PROJECT PARTS

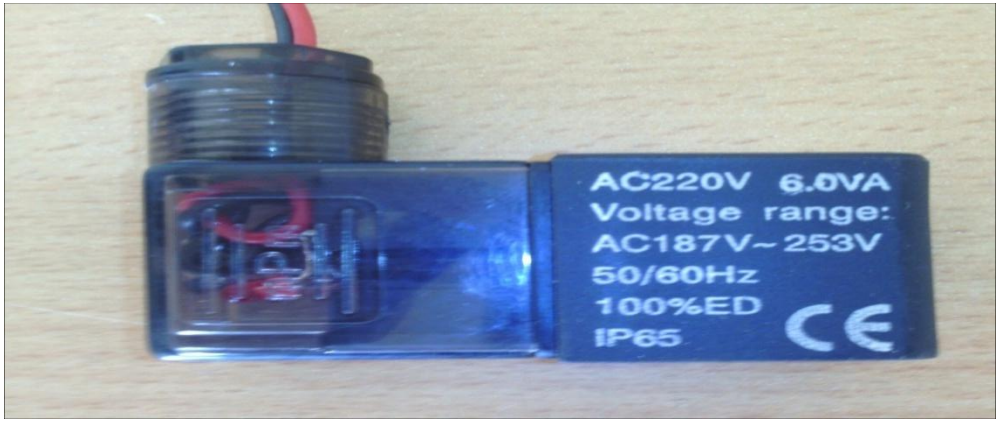
- **Double Acting Cylinder**

120psi Pneumatic double acting cylinder(60*80).

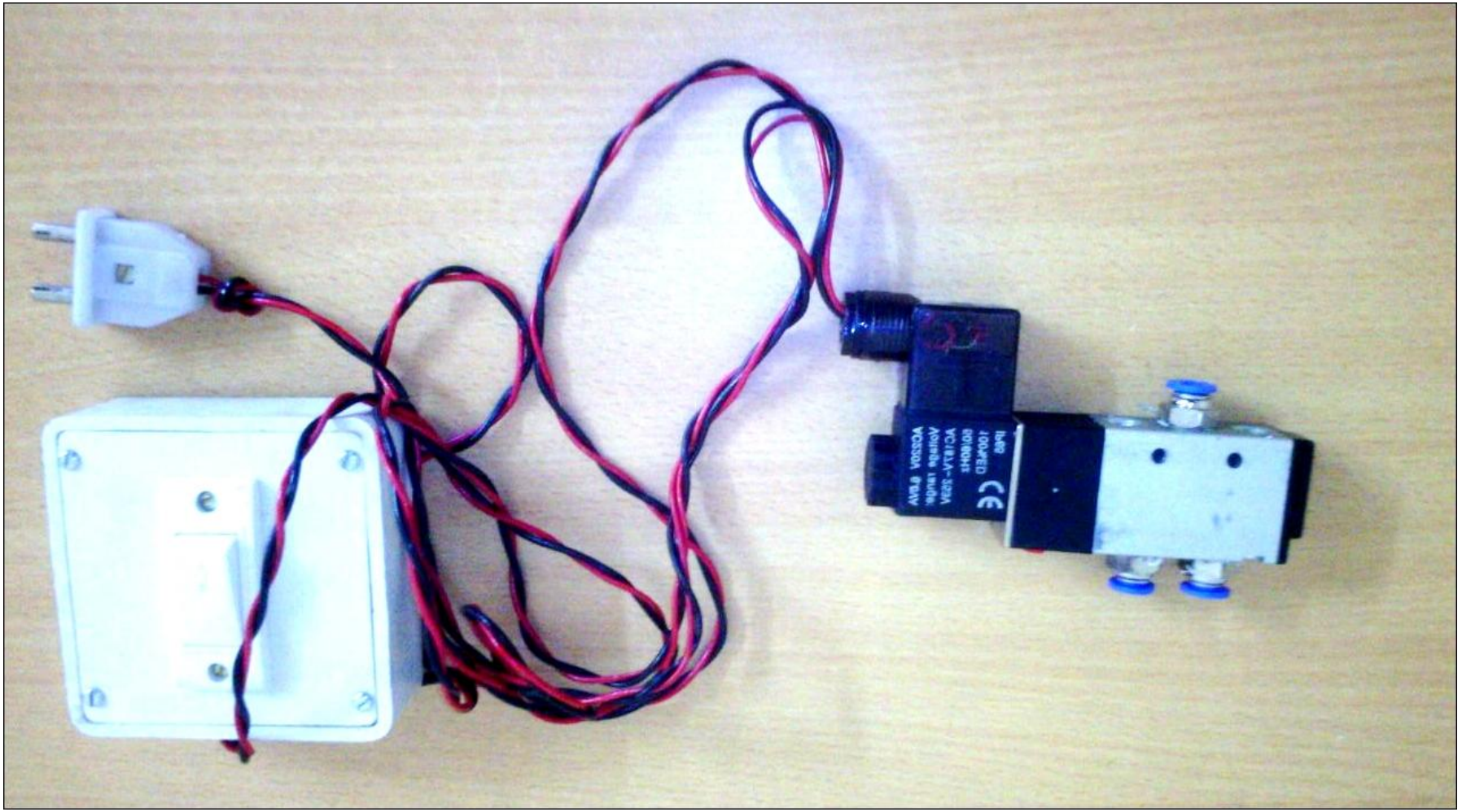
➢ Solenoid valve



Solenoid coil



Solenoid valve wide switch



Fixture of tool

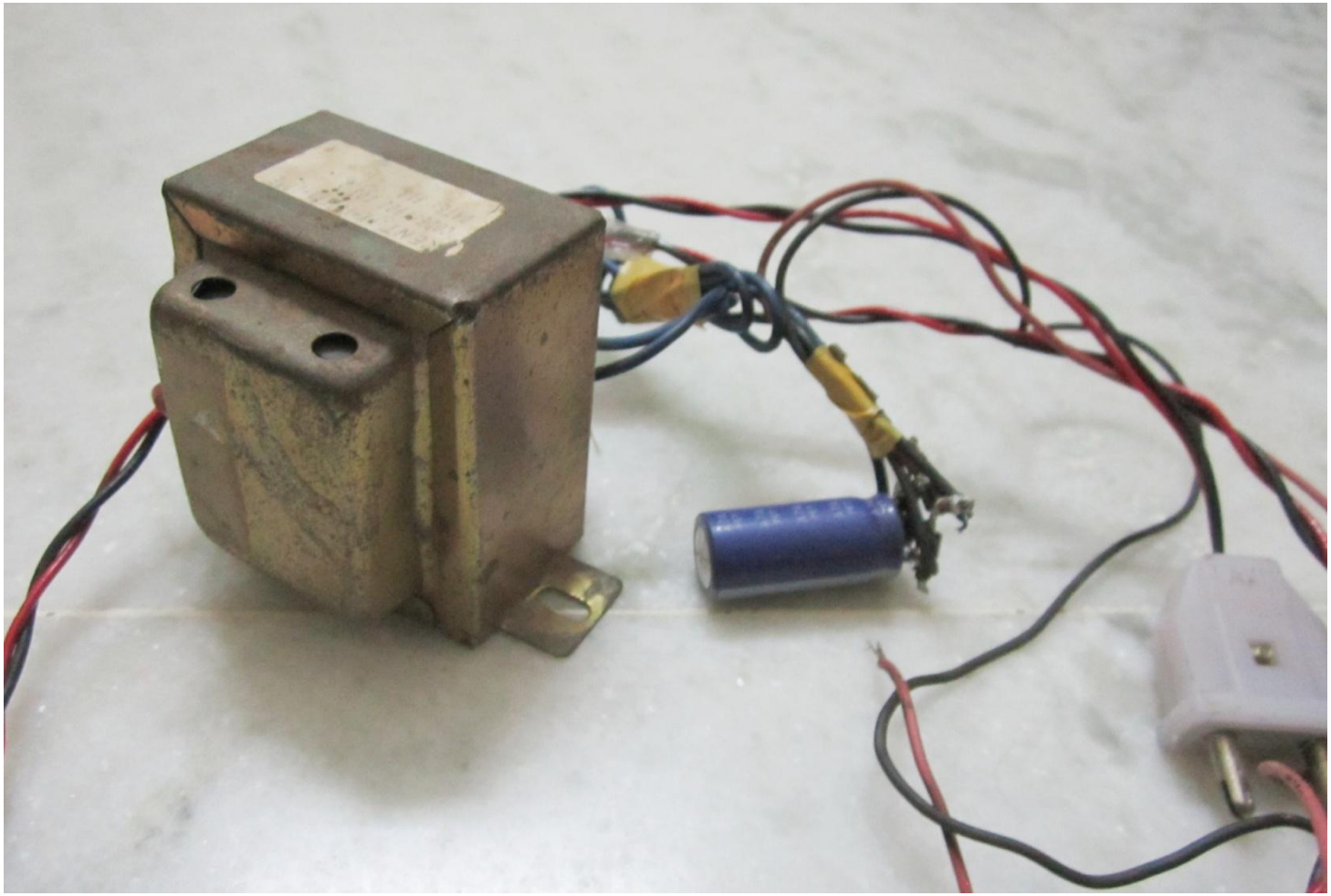
Punching rod (carbon steel)

Tank- 120psi plastic round with 3 out put

Pipe- 190psi ,6mm pipe (air)

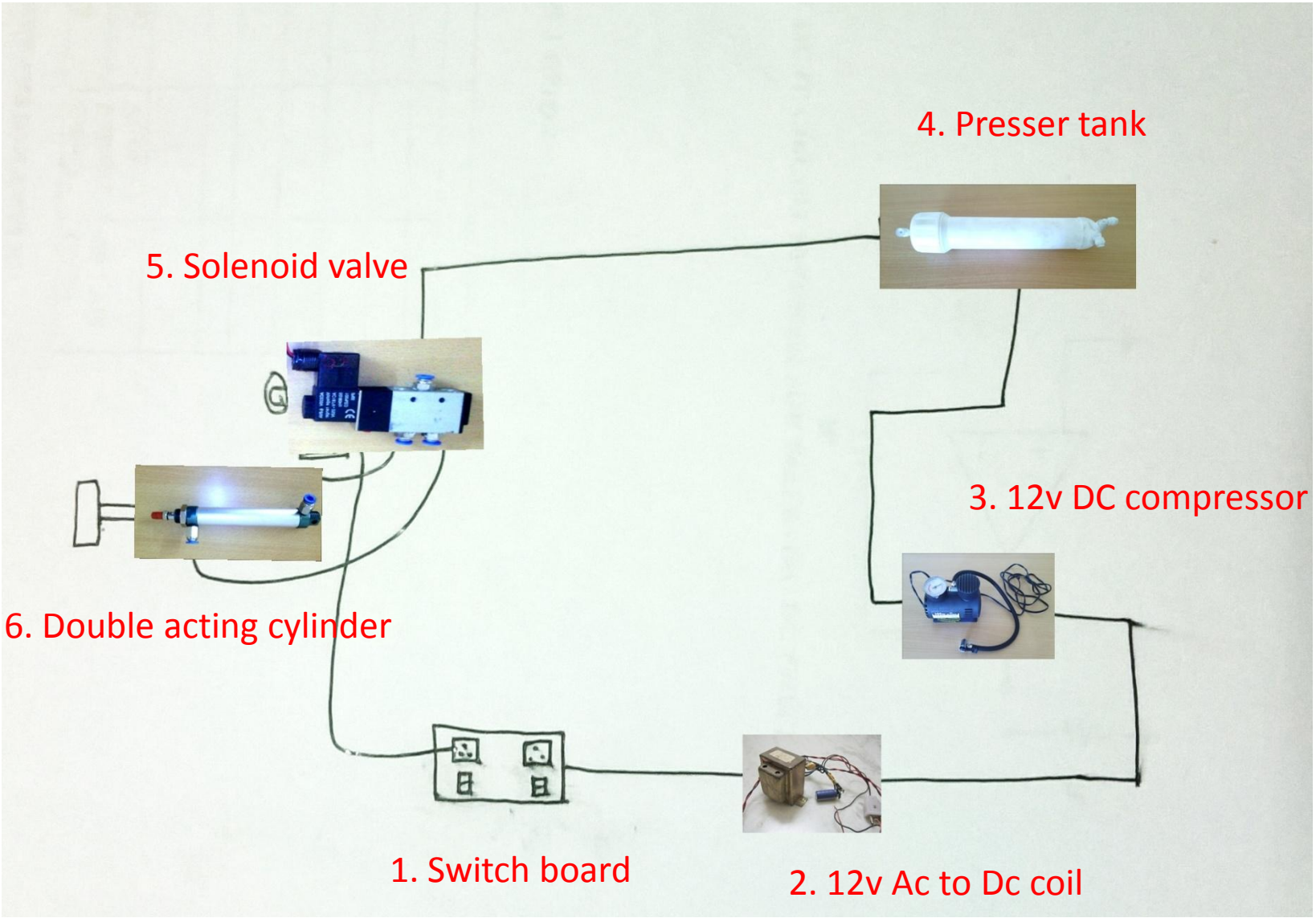
Pipe connector (push)

12v D.C coil

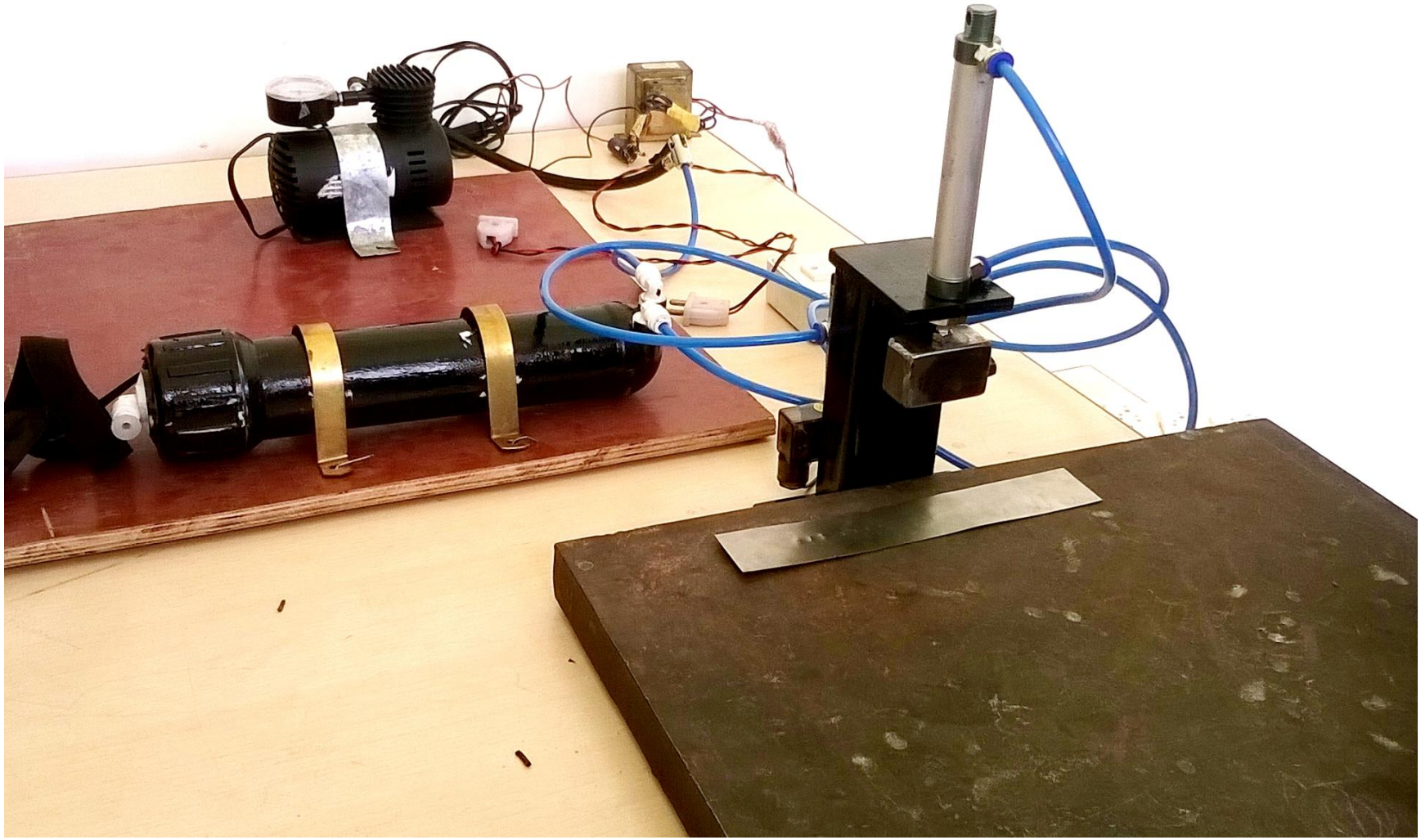


Compressor – 12v D.C , 300psi

Working Layout



Final Working Model



CALCULATION OF FORCE

CYLINDER THRUST

F = Cylinder thrust in Kg.
D = Dia of piston in cm
d = Dia of piston rod in cm.
p = Operating air pressure in “bar”.

Double acting in forward stroke

$$F = \frac{\pi}{4} D^2 \mathrm{p}$$

D= 2.8 cm
P = 6.8 bar

F = 41.87 cm2 bar ……(1)

THEORETICAL AIR CONSUMPTION CALCULATIONS

Let
D = Dia of piston in cm.
d = piston rod dia.
L = stroke in cm.
P = Air pressure in bar

- Free air consumption in liters for forward stroke

$$C = \left\{\frac{\pi}{4} D^2 (P + 1) L\right\} / 1000$$

D= 2.8 cm
P = 6.8 bar
L= 8 cm

= 384.23 cm^3bar ……..(2)

PUNCHING FORCE

Punching force $\boldsymbol{(Fp) = P \times t \times \sigma S}$

Where P= $2 \times tool\ area$

σS= shear strength of punching material

P = length of periphery to be cut in cm.

CALCULATION FOR ALUMINUM ALLOY

t= 0.1 cm

$\boldsymbol{\sigma S}$= 82.7 Mpa of Aluminum 6061

$Fp = P \times t \times \sigma S$

$= (2 \times 0.1 \times 0.1 \times 82.7)$

$= 1.654\ cm2$mpa

Now converting $cm2$Mpa value in $cm2bar$

We know that 1 $cm2$Mpa = 10 $cm2bar$

So that

$\boldsymbol{Fp}$= **16.54** $\boldsymbol{cm2bar}$ **……(3)**

➢ Comparing value of equation 1 and 3 value of project punching machine is higher than required value so that we can easily punch on aluminum 6061 alloy.

CALCULATION FOR CAST IRON

t= 0.1 cm

$\boldsymbol{\sigma S}$= 195 Mpa *Cast* ***Iron***

$Fp = P \times t \times \sigma S$

$= (2 \times 0.1 \times 0.1 \times 195)$

$= 3.9\ cm2$mpa

Now converting $cm2$Mpa value in $cm2bar$

We know that 1 $cm2$Mpa = 10 $cm2bar$

So that

$\boldsymbol{Fp}$= **39** $\boldsymbol{cm2bar}$ **…….(4)**

➢Comparing value of equation 1 and 4 value of project punching machine is higher than required value so that we can easily punch on cast iron.

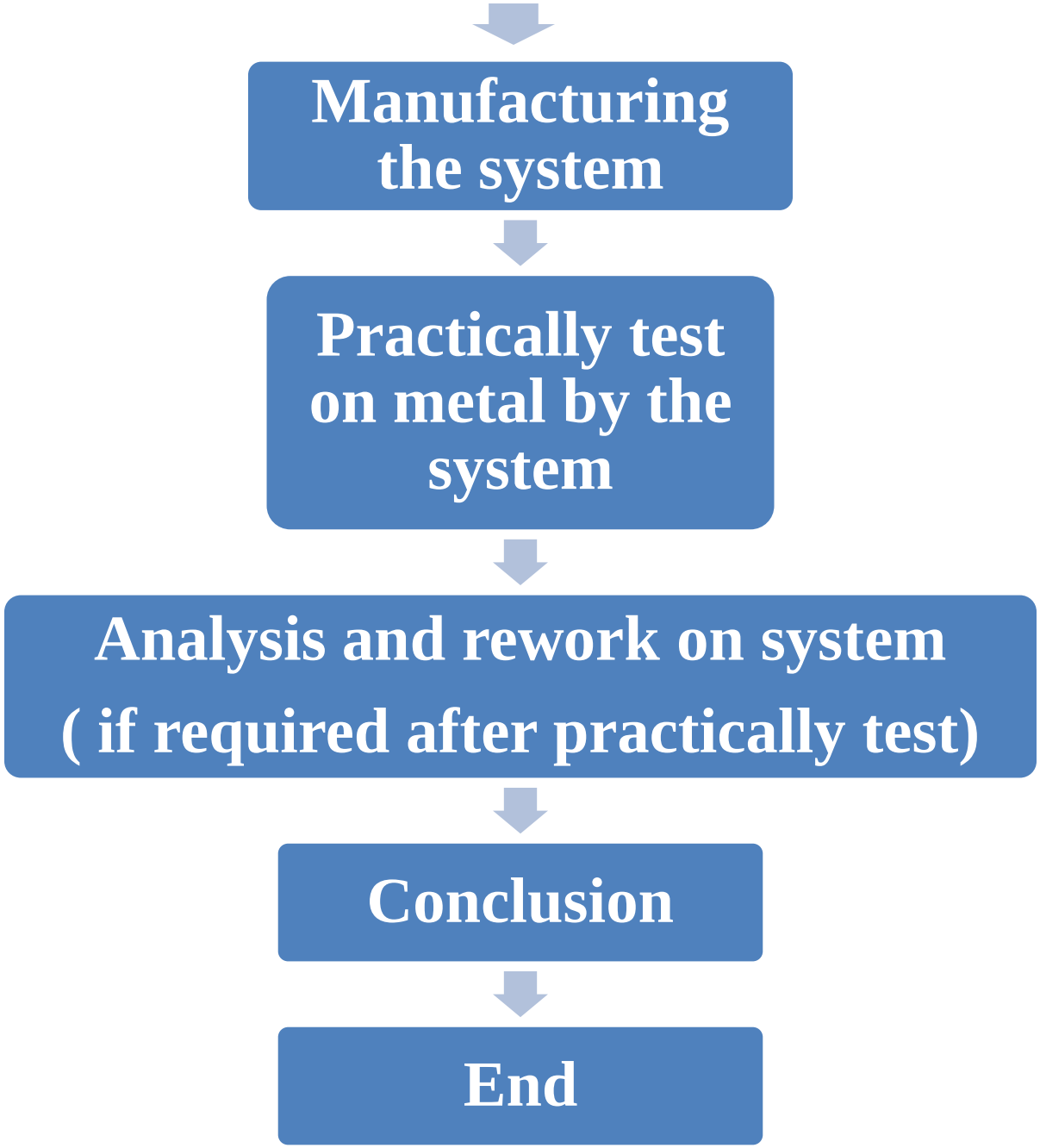
Methodology

Analysis of working principal and details of Pneumatic system.

Modeling system (work in Solid works)

Pressure Calculation of the system.

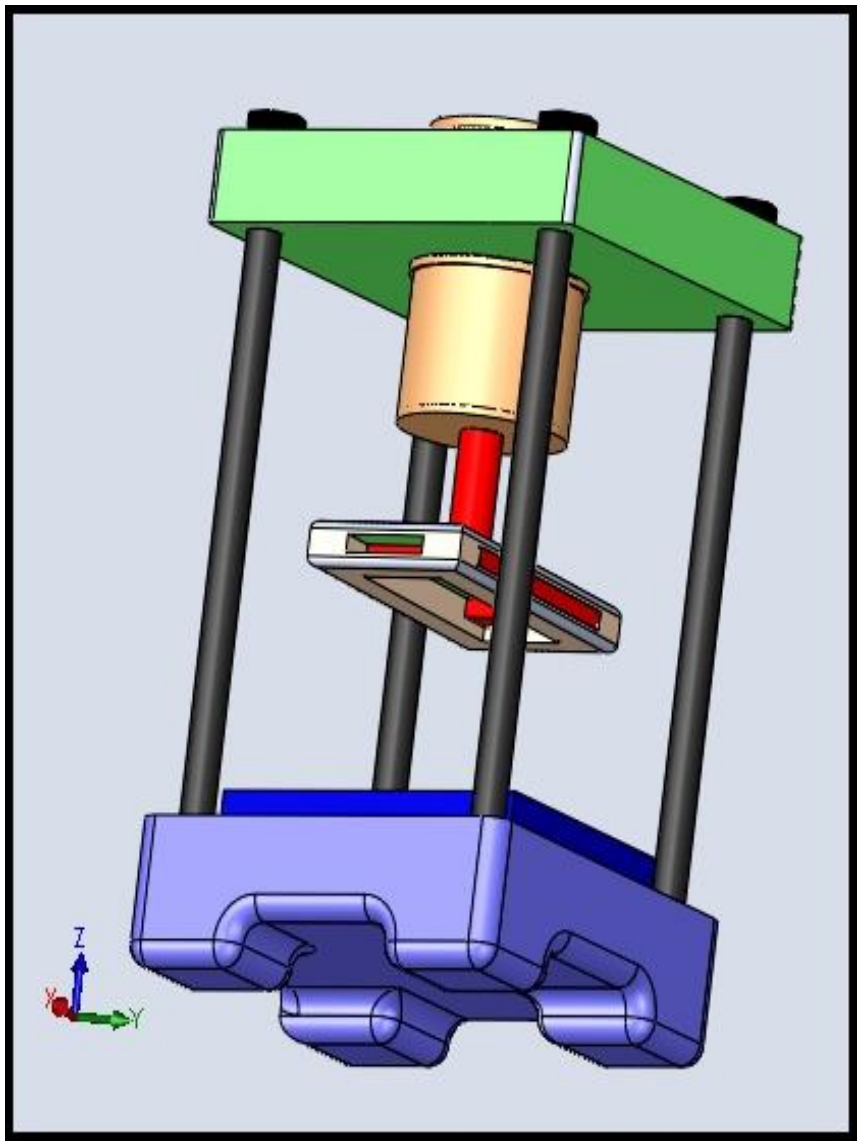
Modeling system as per dimension

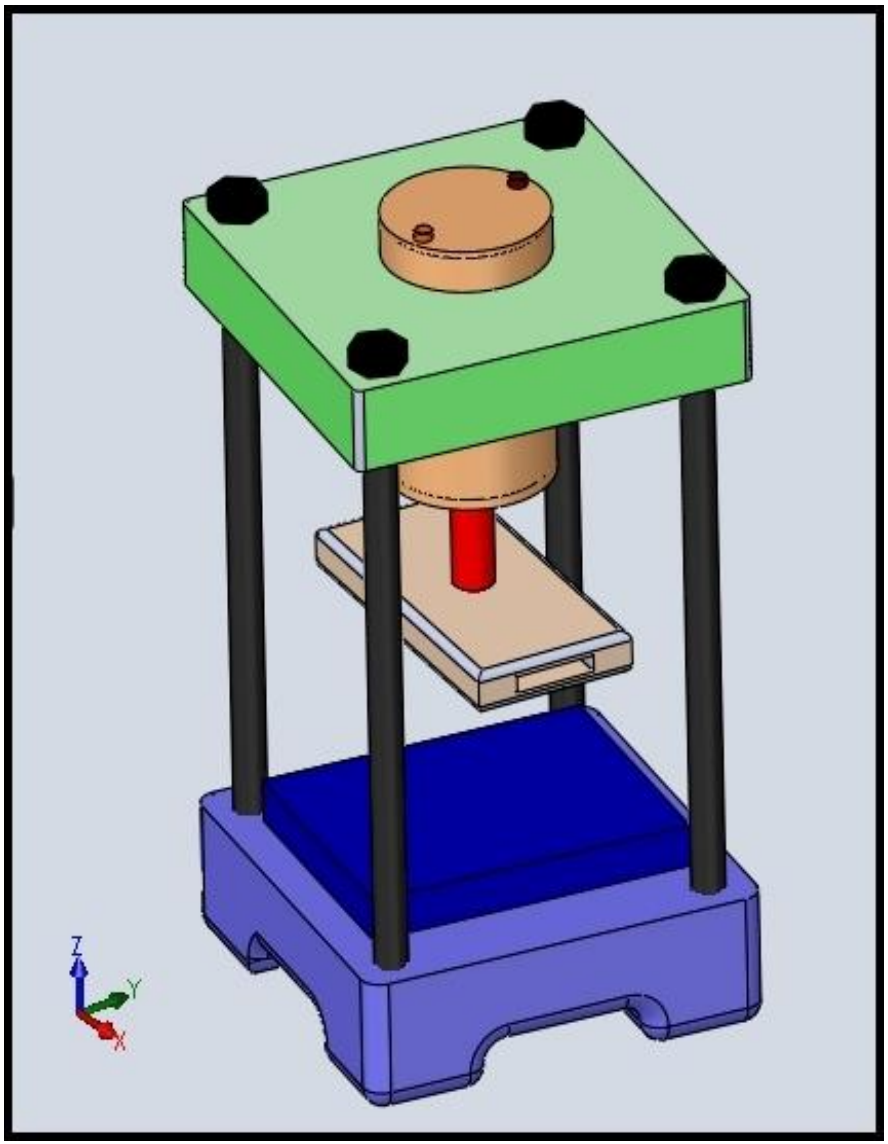

Manufacturing the system
Practically test on metal by the system
Analysis and rework on system
(if required after practically test)
Conclusion
End

MODELING

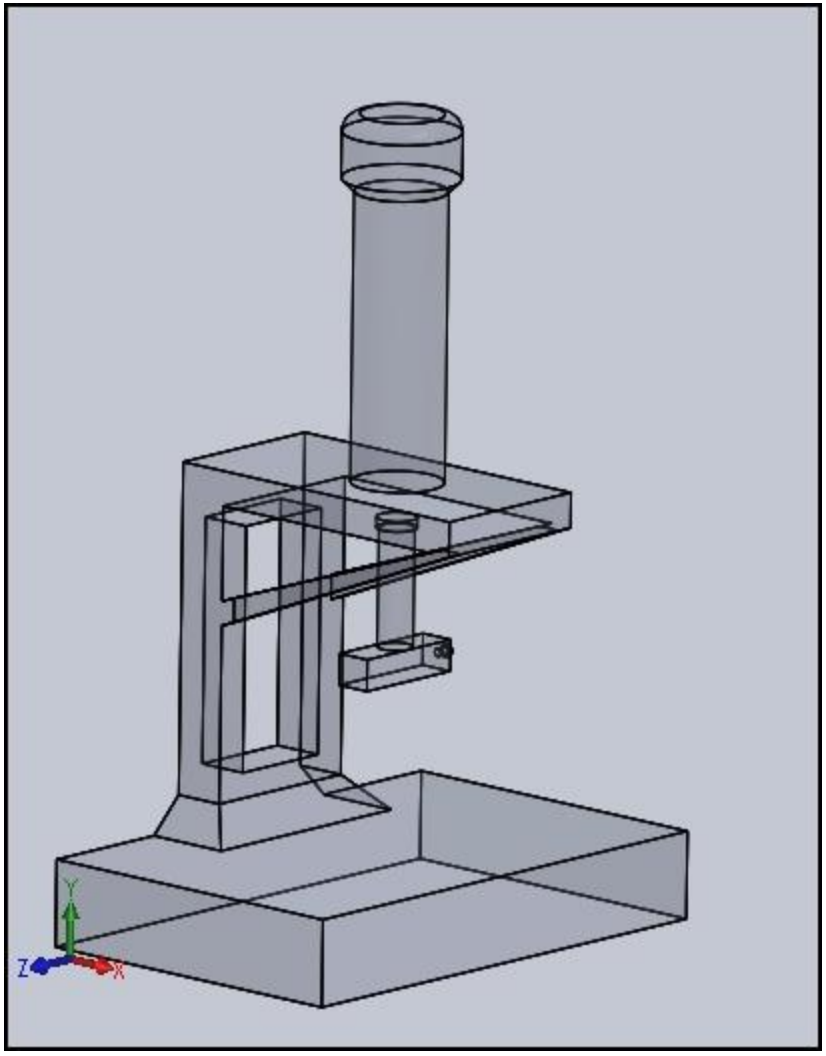
- We use solid works 2013 software.
- Solid works is a computer graphics system for modeling various mechanical designs for performing related design and manufacturing operations.
- The system uses a 3D solid modeling system as the core, and applies the feature base parametric modeling method.
- solid works is a feature based parametric solid modeling system with many extended design and manufacturing application.

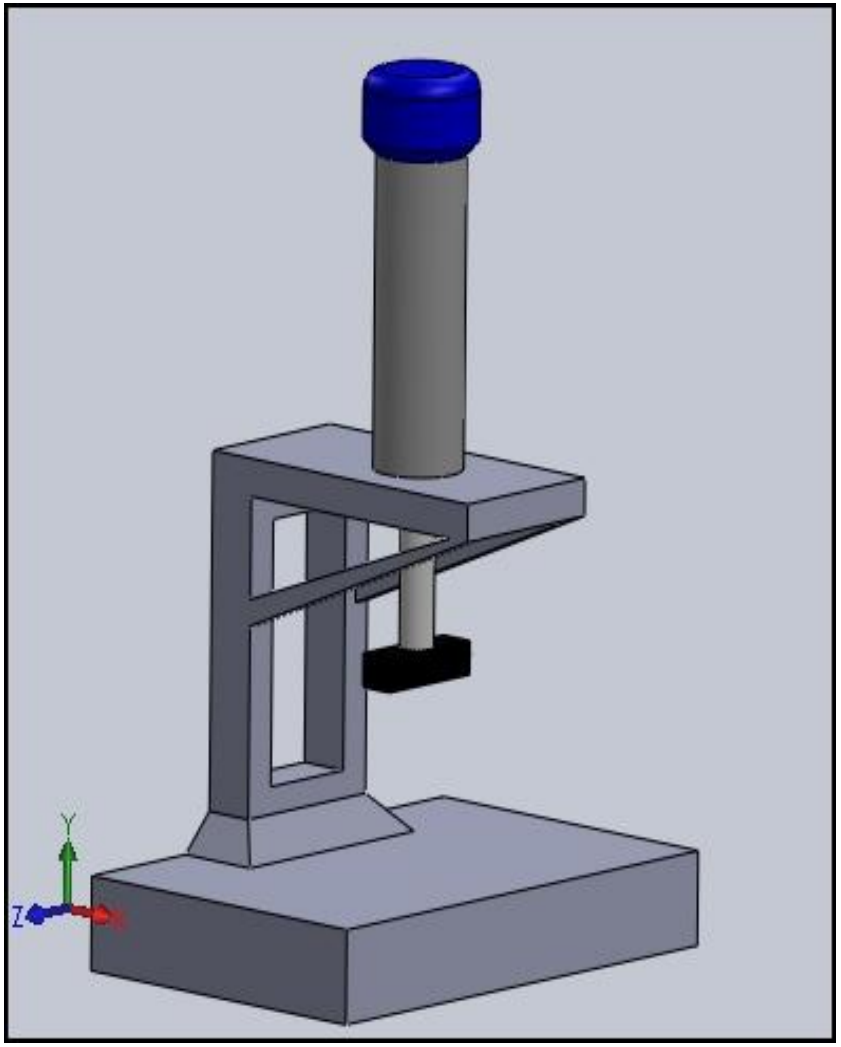
Desire model of project

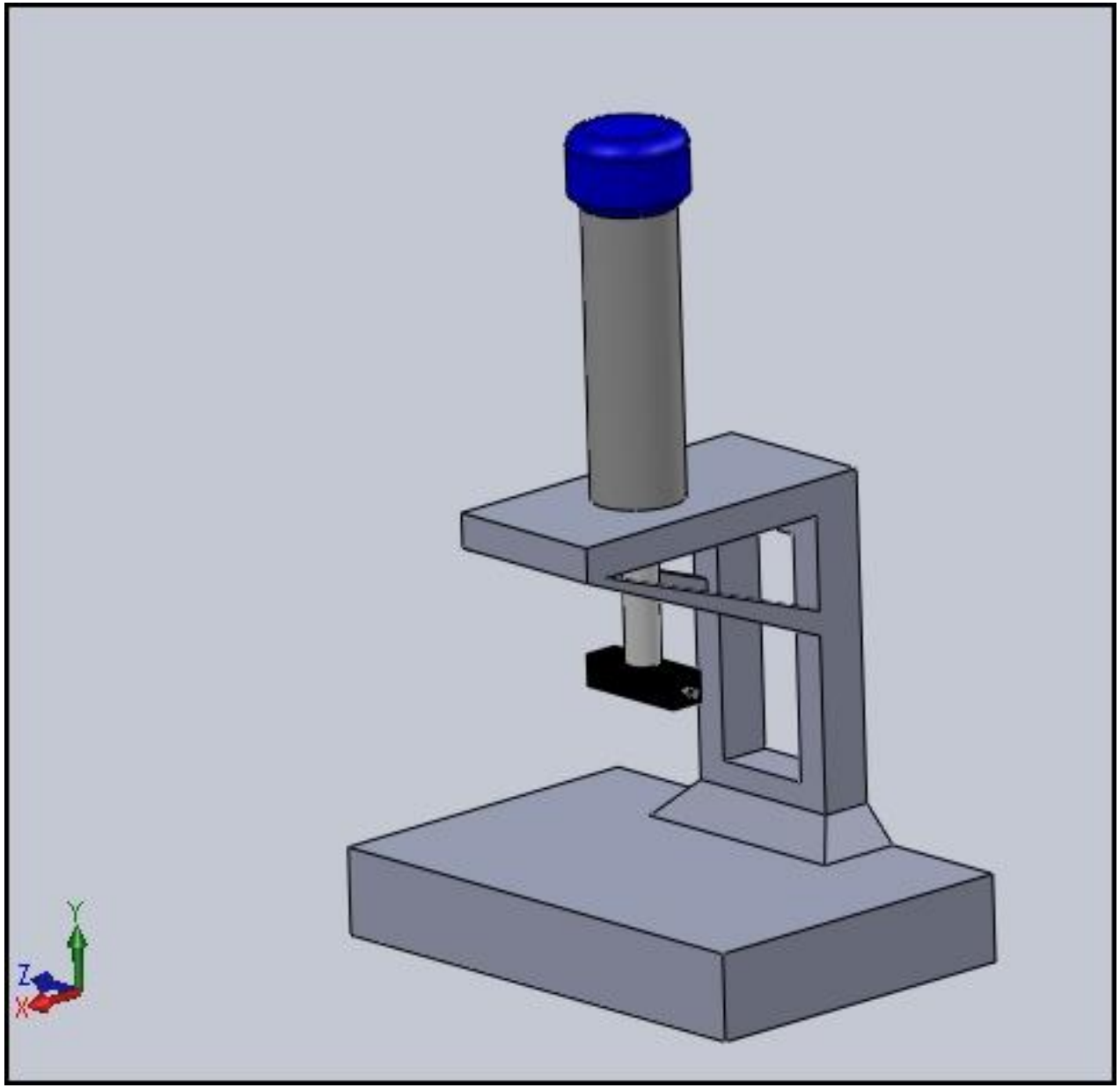




Final model of project






Y
Z
X

Work Plan

SR.NO	WORK PLAN TOPIC	MONTH OF WORK
1	Find out best system.	July
2	Analyses of working principal and detail of new system.	August, September
3	Modeling system	October, November
4	Calculation of system.	December
5	Manufacturing the system	January, February
6	Practically test the system	March
7	analyze and rework on system (if required after practically test)	March
8	Conclusion	April

Conclusion

- Pneumatic system is better than hydraulic system and mechanical system in terms of maintenance, cost, accuracy, Productivity.
- Based on calculation project model work on max 42 bar punching force.

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THANK YOU